



**PRELIMINARY STORMWATER SITE PLAN
FOR THE
10th STREET RESIDENCES
SNOHOMISH, WASHINGTON**

September 18, 2018
REVISED July 15, 2019



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PROJECT OVERVIEW

This Stormwater Site Plan has been prepared for the multi-family project at 1209 10th St. parcel number 00487700001903 in Snohomish, Washington. The 1.35 acre site is located east of the intersection of 10th St and Ave D, see Figure 1: Vicinity Map The project consists of 3 multi-family buildings with access drive and parking. A single access is provided from 10th St. Currently, the site is vacant.

METHODOLOGY

The drainage design for the project has been prepared based on the requirements of the 2014 Department of Ecology Stormwater Management Manual (DOE Manual) as adopted by the City of Snohomish. WWHM2012 as provided by DOE has been used for determining basin runoff and for sizing of the stormwater facilities. Based on the flow charts in Figure 2.4.1 of the DOE Manual and the site parameters, the project is subject to Minimum Requirements 1-9.

The project site parameters are:

- The project is new development.
- The site has less than 35% existing impervious coverage
- The project will create more than 5,000 sf of new or replaced impervious area.

MR 1: PREPARATION OF STORMWATER SITE PLANS

DRAINAGE PLAN DESCRIPTION

Stormwater runoff from paved areas will be collected, treated and conveyed to a detention vault located under the access drive. The roof runoff, being clean, will be collected and conveyed to the detention pond.

WATER QUALITY MEASURES

Following is a list of the proposed construction water quality BMPs. See MR 3: Water Pollution Source Control for more information. The proposed BMPs are as follows:

- BMP C103, High Visibility Fence
- BMP C105, Construction Entrance
- BMP C107, Construction Road/Parking Area Stabilization
- BMP C120, Temporary and Permanent Seeding
- BMP C121, Mulching
- BMP C123, Plastic Covering
- BMP C125, Topsoiling/Composting
- BMP C140, Dust Control
- BMP C220, Storm Inlet Protection
- BMP C240, Sediment Trap

DETENTION SIZING

Flow control will be provided by infiltration trenches that will infiltrate all the runoff from the parking and building roofs. Two infiltration trenches will be utilized with the first placed under the parking lot for Building A and controlling roof runoff. The second infiltration trench will be located near the south end of the property between Buildings B and C under the access road. This second trench will infiltrate all the runoff from the parking lot and Building B and C roofs. Conveyance calculations will be provided with the final drainage report to be prepared with the construction documents.

STORMWATER TREATMENT BMP'S

The roof runoff is considered clean and treatment is not required. A Filterra pre-manufactured treatment system will treat the access drive runoff prior to the detention vault.

PROTECTION OF WETLANDS

There is a Category II wetland on the southern portion of the property. A protective wetland buffer will be established and maintained.

OPERATIONS AND MAINTENANCE

This will be provided with the permit documents after preliminary approval.

EXISTING CONDITIONS SUMMARY

DESCRIPTION

The site is located east of the intersection of 10th St and Ave D. The 1.39 acre, triangular site is currently vacant with a ground cover of unmaintained grass and native shrubs. The topography descends from 10th St. at elevation 140 down to the wetlands at elevation 108 with commercial buildings to the west and south and residential buildings to the east and north. See Appendix A Figure 2: Existing Site Map for more information.

SOILS DESCRIPTION

Nelson Geotechnical Associates, Inc. prepared a geotechnical report for the property. Their test pits encountered topsoil and old fill of varying depths overlying fine to coarse sand interpreted as native outwash deposits. Nelson has provided an infiltration rate of 4 in/hr based on grain size analysis. See geotechnical report under separate cover.

EXISTING BASIN

The existing basin is based on the project developed area and contains 1.35 acres. Runoff calculations are based on the forested site conditions and C class soils.

OFFSITE ANALYSIS & MITIGATION

The site proposes infiltration of 100% of the collected runoff. There should be no off-site impacts.

UPSTREAM ANALYSIS

The site is bounded by 10th St to the north, commercial properties to the west and a wetland to the south. To the east is a residential housing complex. The road blocks drainage from the north, the commercial properties from the west and the residential complex from the east. The wetland is the low drainage point; with a 24 inch pipe discharging into the wetland from the commercial area to the west.

DOWNSTREAM ANALYSIS

Full infiltration of site stormwater is proposed. No new runoff will be introduced to the downstream system.

PROPOSED CONDITIONS SUMMARY

The site will be developed with 3 multi-family buildings with above and below ground parking. Road access will be from 10th St. to the north. One multi-family building will be north by 10th St. with the other 2 are on the south end of the property. See Appendix A Figure 3: Developed Conditions.

MR 2: CONSTRUCTION STORMWATER POLLUTION PREVENTION (SWPP)

This SWPPP Narrative has been prepared for the 10th St. Residential Project land use review and is conceptual in nature. The project proposes greater than 1 acre of land disturbing activities and will require a Department of Ecology Construction Stormwater General Permit.

The construction site has the following characteristics:

Disturbed Area: Approximately 1.35 ac
Soil Type: Native outwash deposits
Average slope: 3-55%
Critical Areas: A wetland is located in the south-east corner of the property

1. CONSTRUCTION STORMWATER POLLUTION PREVENTION ELEMENTS

A Construction Stormwater Management Plan will be prepared that addresses the 13 Required Elements summarized below:

Element #1: Mark Clearing Limits

The construction plans will delineate the limits of the clearing for the site. These will be located in the field prior to clearing taking place.

Element #2: Establish Construction Access

Construction access will be taken from the north access point at 10th St. A stabilized construction entrance will be installed at that location.

Element #3: Control Flow Rates

A sediment trap will control flow rates.

Element #4: Install Sediment Controls

Sediment controls and their installation will be delineated on the construction documents in the future.

Element #5: Stabilize Soils

In planting areas, the exposed soils will be stabilized per BMPs C120, C121, C123, and C125. In paved areas the soils will be stabilized by the placement of the rock base course as part of BMP C107. Temporary stockpiles will be mulched, seeded or covered with plastic.

Element #6: Protect Slopes

Graded slopes will be mulched and seeded or protected by construction of rockery.

Element #7: Protect Drain Inlets

The existing storm drains along 10th St. will be protected with filter inserts.

Element #8: Stabilize Channels and Outlets

No channels or outfalls are proposed.

Element #9: Control of Pollutants

All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris.

Element #10: Control De-Watering

No dewatering is expected as no excavation to the water table is anticipated.

Element #11: Maintain BMPs

Notes for the maintenance of erosion control facilities will be included on the construction plans.

Element #12: Manage the Project

The project will be subject to seasonal work limitations, site inspection and monitoring as required by the City of Snohomish. Erosion control monitoring and supervision will be managed by a CESCL.

Element #13: Protect Low Impact Development

The Filterra unit will be protected from excess sediment during construction.

MR 3: WATER POLLUTION SOURCE CONTROL

PERMANENT SOURCE CONTROL BMPs

Being a residential development, source control will consist of maintained garbage facilities, maintenance of the storm drain system, and pavement sweeping.

MR 4: PRESERVATION OF NATURAL DRAINAGE

The proposal is to infiltrate runoff into the native outwash soils. There will be no downstream impact.

MR 5: ON-SITE STORMWATER MANAGEMENT

This site is located in a UGA (the City of Snohomish) and triggers MRs 1-9. Per the DOE Manual, the site is required to meet the Low Impact Development Performance Standard and BMP T5.13 or can use List #2. The site is proposing infiltrating 100% of the site runoff (see MR 7) and therefore will meet the Performance Standard. List #2 is not required for review. BMP T5.13 will be implemented on all disturbed, pervious surfaces.

LAWN AND LANDSCAPE AREAS:

BMP T5.13 POST CONSTRUCTION SOIL QUALITY AND DEPTH

Post Construction Soil Quality and Depth will be used on the site to recondition those areas that have been compacted by construction traffic. Stockpiled native topsoil or imported topsoil will be used in the planted areas as needed. The intent of this BMP is to re-establish the natural ability of the soil to infiltrate runoff as in the uncompacted predeveloped condition. Additional information is provided on the construction drawings that are part of the construction permit submittal.

MR 6: RUNOFF TREATMENT

With more than 5,000 sf of pollution generating impervious surface the site requires runoff treatment. Storm water treatment of the parking lot runoff will be accomplished through the use of a Filterra system. The system is approved for standalone general use has Department of Ecology GULD approval for enhanced treatment and is sized to treat 91% runoff while safely conveying larger stormwater events to the infiltration facility.

The treatment basin includes the parking lot and lawn areas and requires runoff treatment. The Filterra Treatment System has been chosen for treatment of the treatment basin runoff.

FILTERRA OPERATION

Stormwater runoff enters the Filterra bioretention system through curb-inlet opening and flows through a specially designed filter media mixture contained in the landscaped concrete container. The filter media captures and immobilizes pollutants; those pollutants are then decomposed, volatilized and incorporated into the biomass of the Filterra system's micro/macro fauna and flora. Stormwater runoff flows through the media and into an underdrain system at the bottom of the container, where the treated water is discharged.

FILTERRA SIZING

Treatment facility has been performed using WWHM2012 with the parameters based on Contech's approved media, see output in APPENDIX B. For this site a Filterra Facility with a 6'x6' filter bed in a 6'x8' vault will treat 94.9% of the ground basin runoff. This exceeds the required treatment level of 91% of the total runoff record. The facility will be located at the very south end of the basin and will drain into the underground detention vault see WWHM2012 report for the sizing calculations in APPENDIX B.

MR 7: FLOW CONTROL

WWHM2012 software was used to calculate runoff and design the proposed infiltration trenches. The infiltration trench will allow for 100% infiltration per the Ecology flow duration standards. The first infiltration is located just south of building A under the parking lot to handle roof runoff. The second infiltration trench will be located under the south access parking lot and will received inflow from Building B and C as well as from the Filterra treatment unit.

The following data summarizes the sizing of the infiltration facility:

Infiltration Rate:	4 inches per hour
Trench 1	
Width	5 feet
Length	60 feet
Depth	4 feet
Trench 2	
Width	17 feet
Length	80 feet
Depth	5 feet

See attached WWHM2012 report in Appendix B.

MR 8: WETLANDS PROTECTION

A Category II wetland is located at the southeastern corner of the site. It will be protected by a 100 foot buffer that will be averaged and maintained as directed by the critical areas study. The sections of the buffer zone that are less than 100 feet will be mitigated. It is expected that infiltrated runoff will encounter the groundwater table and slowly flow into the wetland.

MR 9: BASIN/WATERSHED PLANNING

The City of Snohomish does not have any specific drainage basin or watershed requirements for this area.

MR 10: OPERATION AND MAINTENANCE

A full operations and Maintenance Manual will accompany the final drainage report.

APPENDIX A
FIGURES



FIGURE 1: VICINITY MAP

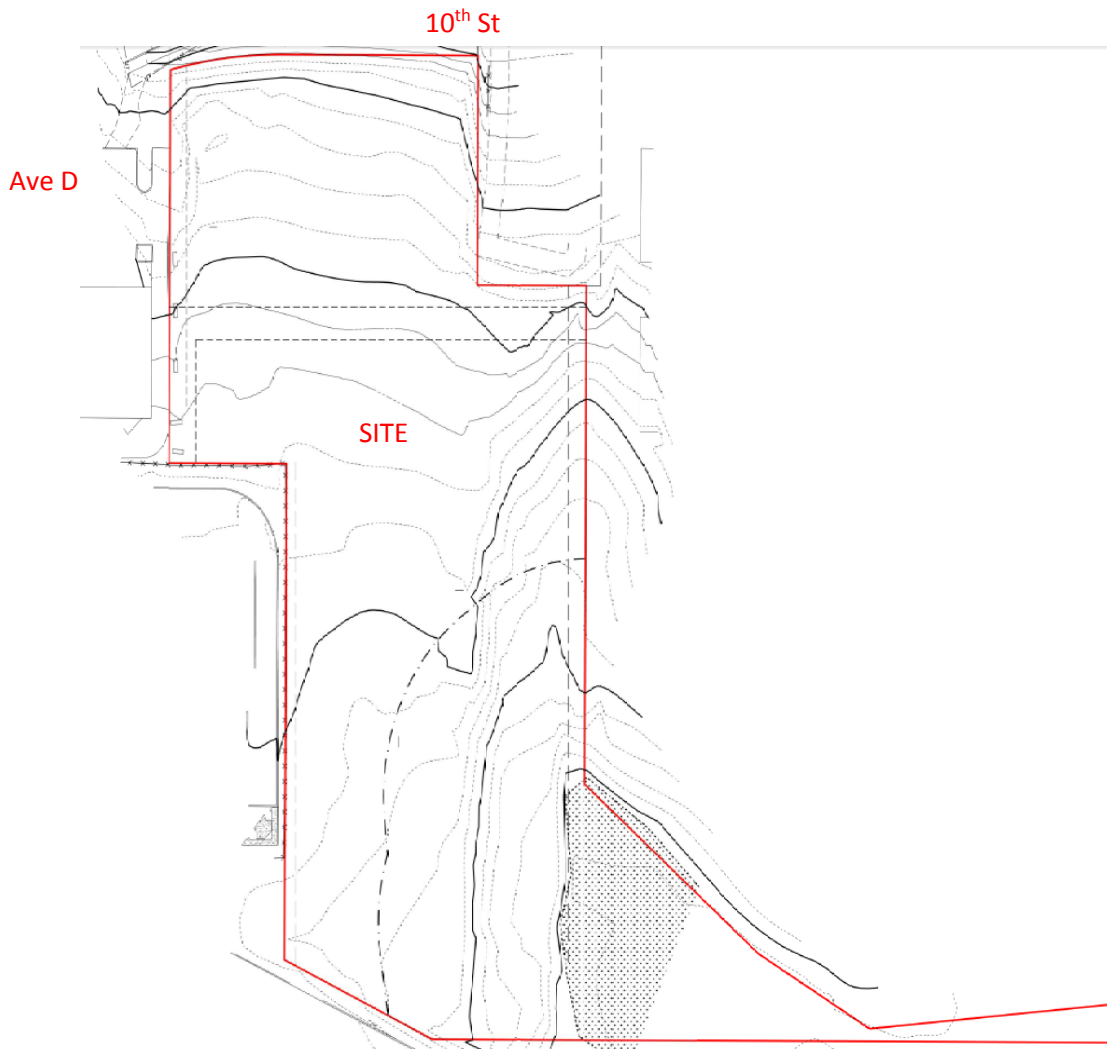


FIGURE 2: EXISTING SITE MAP

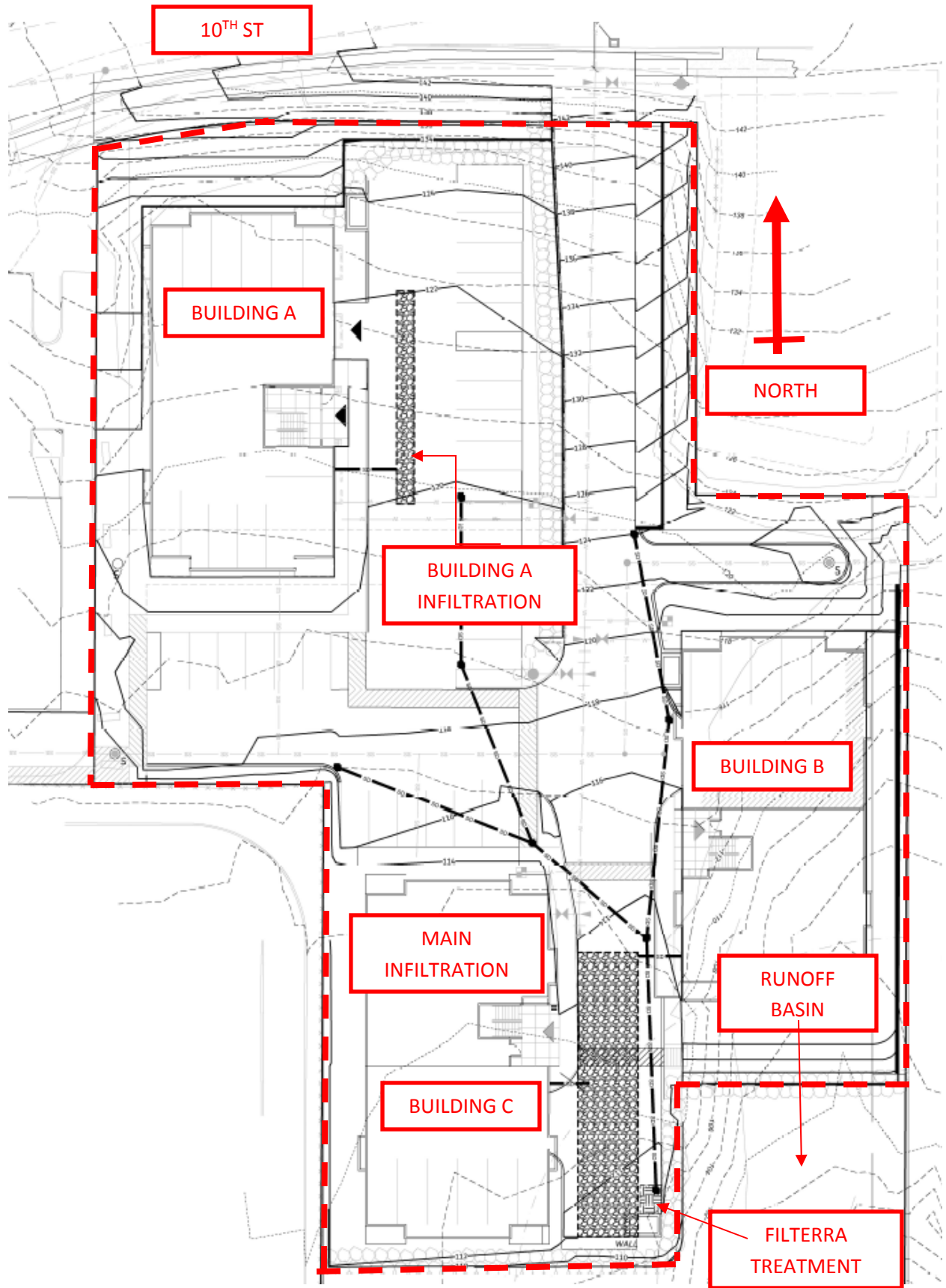


FIGURE 3 DEVELOPED CONDITIONS

APPENDIX B
WWHM2012 REPORT

WWHM2012
PROJECT REPORT

Project Name: 18-038 echelbarger
Site Name:
Site Address:
City :
Report Date: 7/15/2019
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.20
Version Date: 2018/07/12
Version : 4.2.15

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Forest, Mod	1.39

Pervious Total	1.39
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<u>Impervious Land Use</u>	<u>acre</u>
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Impervious Total	0
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Basin Total	1.39
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Element Flows To:		
Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : driveways
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Lawn, Mod	.41

Pervious Total	0.41
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<u>Impervious Land Use</u>	<u>acre</u>
ROADS MOD	0.51

Impervious Total 0.51

Basin Total 0.92

Element Flows To:

Surface Interflow Groundwater
Sand Filter 1 Sand Filter 1

Name : Vault 1

Width : 30 ft.

Length : 70 ft.

Depth: 11 ft.

Discharge Structure

Riser Height: 10 ft.

Riser Diameter: 18 in.

Orifice 1 Diameter: 0.66 in. Elevation: 0 ft.

Orifice 2 Diameter: 1.18 in. Elevation: 6.46 ft.

Orifice 3 Diameter: 0.71 in. Elevation: 7.81375000000003 ft.

Element Flows To:

Outlet 1 Outlet 2

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.048	0.000	0.000	0.000
0.1222	0.048	0.005	0.004	0.000
0.2444	0.048	0.011	0.005	0.000
0.3667	0.048	0.017	0.007	0.000
0.4889	0.048	0.023	0.008	0.000
0.6111	0.048	0.029	0.009	0.000
0.7333	0.048	0.035	0.010	0.000
0.8556	0.048	0.041	0.010	0.000
0.9778	0.048	0.047	0.011	0.000
1.1000	0.048	0.053	0.012	0.000
1.2222	0.048	0.058	0.013	0.000
1.3444	0.048	0.064	0.013	0.000
1.4667	0.048	0.070	0.014	0.000
1.5889	0.048	0.076	0.014	0.000
1.7111	0.048	0.082	0.015	0.000
1.8333	0.048	0.088	0.016	0.000
1.9556	0.048	0.094	0.016	0.000
2.0778	0.048	0.100	0.017	0.000
2.2000	0.048	0.106	0.017	0.000
2.3222	0.048	0.112	0.018	0.000
2.4444	0.048	0.117	0.018	0.000
2.5667	0.048	0.123	0.018	0.000
2.6889	0.048	0.129	0.019	0.000
2.8111	0.048	0.135	0.019	0.000
2.9333	0.048	0.141	0.020	0.000
3.0556	0.048	0.147	0.020	0.000
3.1778	0.048	0.153	0.021	0.000
3.3000	0.048	0.159	0.021	0.000
3.4222	0.048	0.165	0.021	0.000
3.5444	0.048	0.170	0.022	0.000
3.6667	0.048	0.176	0.022	0.000
3.7889	0.048	0.182	0.023	0.000

3.9111	0.048	0.188	0.023	0.000
4.0333	0.048	0.194	0.023	0.000
4.1556	0.048	0.200	0.024	0.000
4.2778	0.048	0.206	0.024	0.000
4.4000	0.048	0.212	0.024	0.000
4.5222	0.048	0.218	0.025	0.000
4.6444	0.048	0.223	0.025	0.000
4.7667	0.048	0.229	0.025	0.000
4.8889	0.048	0.235	0.026	0.000
5.0111	0.048	0.241	0.026	0.000
5.1333	0.048	0.247	0.026	0.000
5.2556	0.048	0.253	0.027	0.000
5.3778	0.048	0.259	0.027	0.000
5.5000	0.048	0.265	0.027	0.000
5.6222	0.048	0.271	0.028	0.000
5.7444	0.048	0.276	0.028	0.000
5.8667	0.048	0.282	0.028	0.000
5.9889	0.048	0.288	0.028	0.000
6.1111	0.048	0.294	0.029	0.000
6.2333	0.048	0.300	0.029	0.000
6.3556	0.048	0.306	0.029	0.000
6.4778	0.048	0.312	0.035	0.000
6.6000	0.048	0.318	0.044	0.000
6.7222	0.048	0.324	0.050	0.000
6.8444	0.048	0.330	0.054	0.000
6.9667	0.048	0.335	0.058	0.000
7.0889	0.048	0.341	0.061	0.000
7.2111	0.048	0.347	0.064	0.000
7.3333	0.048	0.353	0.067	0.000
7.4556	0.048	0.359	0.070	0.000
7.5778	0.048	0.365	0.072	0.000
7.7000	0.048	0.371	0.074	0.000
7.8222	0.048	0.377	0.078	0.000
7.9444	0.048	0.383	0.084	0.000
8.0667	0.048	0.388	0.088	0.000
8.1889	0.048	0.394	0.091	0.000
8.3111	0.048	0.400	0.095	0.000
8.4333	0.048	0.406	0.098	0.000
8.5556	0.048	0.412	0.101	0.000
8.6778	0.048	0.418	0.103	0.000
8.8000	0.048	0.424	0.106	0.000
8.9222	0.048	0.430	0.109	0.000
9.0444	0.048	0.436	0.111	0.000
9.1667	0.048	0.441	0.113	0.000
9.2889	0.048	0.447	0.116	0.000
9.4111	0.048	0.453	0.118	0.000
9.5333	0.048	0.459	0.120	0.000
9.6556	0.048	0.465	0.122	0.000
9.7778	0.048	0.471	0.125	0.000
9.9000	0.048	0.477	0.127	0.000
10.022	0.048	0.483	0.181	0.000
10.144	0.048	0.489	1.000	0.000
10.267	0.048	0.494	2.256	0.000
10.389	0.048	0.500	3.644	0.000
10.511	0.048	0.506	4.874	0.000
10.633	0.048	0.512	5.731	0.000
10.756	0.048	0.518	6.300	0.000
10.878	0.048	0.524	6.781	0.000
11.000	0.048	0.530	7.230	0.000
11.122	0.048	0.536	7.653	0.000
11.244	0.000	0.000	8.053	0.000

Name : Sand Filter 1
Bottom Length: 6.00 ft.

Bottom Width: 6.00 ft.
Depth: 0.85 ft.
Side slope 1: 0 To 1
Side slope 2: 0 To 1
Side slope 3: 0 To 1
Side slope 4: 0 To 1
Filtration On
Hydraulic conductivity: 70.92
Depth of filter medium: 1.8
Total Volume Infiltrated (ac-ft.): 128.65
Total Volume Through Riser (ac-ft.): 8.177
Total Volume Through Facility (ac-ft.): 136.828
Percent Infiltrated: 94.02
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 0.7 ft.
Riser Diameter: 100 in.

Element Flows To:
Outlet 1 **Outlet 2**
 Gravel Trench Bed 1 Gravel Trench Bed 1

Sand Filter Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.000826	0.000000	0.000	0.000
0.0094	0.000826	0.000008	0.000	0.059
0.0189	0.000826	0.000016	0.000	0.059
0.0283	0.000826	0.000023	0.000	0.060
0.0378	0.000826	0.000031	0.000	0.060
0.0472	0.000826	0.000039	0.000	0.060
0.0567	0.000826	0.000047	0.000	0.061
0.0661	0.000826	0.000055	0.000	0.061
0.0756	0.000826	0.000062	0.000	0.061
0.0850	0.000826	0.000070	0.000	0.061
0.0944	0.000826	0.000078	0.000	0.062
0.1039	0.000826	0.000086	0.000	0.062
0.1133	0.000826	0.000094	0.000	0.062
0.1228	0.000826	0.000101	0.000	0.063
0.1322	0.000826	0.000109	0.000	0.063
0.1417	0.000826	0.000117	0.000	0.063
0.1511	0.000826	0.000125	0.000	0.064
0.1606	0.000826	0.000133	0.000	0.064
0.1700	0.000826	0.000140	0.000	0.064
0.1794	0.000826	0.000148	0.000	0.065
0.1889	0.000826	0.000156	0.000	0.065
0.1983	0.000826	0.000164	0.000	0.065
0.2078	0.000826	0.000172	0.000	0.065
0.2172	0.000826	0.000180	0.000	0.066
0.2267	0.000826	0.000187	0.000	0.066
0.2361	0.000826	0.000195	0.000	0.066
0.2456	0.000826	0.000203	0.000	0.067
0.2550	0.000826	0.000211	0.000	0.067
0.2644	0.000826	0.000219	0.000	0.067
0.2739	0.000826	0.000226	0.000	0.068
0.2833	0.000826	0.000234	0.000	0.068
0.2928	0.000826	0.000242	0.000	0.068
0.3022	0.000826	0.000250	0.000	0.069
0.3117	0.000826	0.000258	0.000	0.069
0.3211	0.000826	0.000265	0.000	0.069
0.3306	0.000826	0.000273	0.000	0.070
0.3400	0.000826	0.000281	0.000	0.070

0.3494	0.000826	0.000289	0.000	0.070
0.3589	0.000826	0.000297	0.000	0.070
0.3683	0.000826	0.000304	0.000	0.071
0.3778	0.000826	0.000312	0.000	0.071
0.3872	0.000826	0.000320	0.000	0.071
0.3967	0.000826	0.000328	0.000	0.072
0.4061	0.000826	0.000336	0.000	0.072
0.4156	0.000826	0.000343	0.000	0.072
0.4250	0.000826	0.000351	0.000	0.073
0.4344	0.000826	0.000359	0.000	0.073
0.4439	0.000826	0.000367	0.000	0.073
0.4533	0.000826	0.000375	0.000	0.074
0.4628	0.000826	0.000382	0.000	0.074
0.4722	0.000826	0.000390	0.000	0.074
0.4817	0.000826	0.000398	0.000	0.074
0.4911	0.000826	0.000406	0.000	0.075
0.5006	0.000826	0.000414	0.000	0.075
0.5100	0.000826	0.000421	0.000	0.075
0.5194	0.000826	0.000429	0.000	0.076
0.5289	0.000826	0.000437	0.000	0.076
0.5383	0.000826	0.000445	0.000	0.076
0.5478	0.000826	0.000453	0.000	0.077
0.5572	0.000826	0.000461	0.000	0.077
0.5667	0.000826	0.000468	0.000	0.077
0.5761	0.000826	0.000476	0.000	0.078
0.5856	0.000826	0.000484	0.000	0.078
0.5950	0.000826	0.000492	0.000	0.078
0.6044	0.000826	0.000500	0.000	0.078
0.6139	0.000826	0.000507	0.000	0.079
0.6233	0.000826	0.000515	0.000	0.079
0.6328	0.000826	0.000523	0.000	0.079
0.6422	0.000826	0.000531	0.000	0.080
0.6517	0.000826	0.000539	0.000	0.080
0.6611	0.000826	0.000546	0.000	0.080
0.6706	0.000826	0.000554	0.000	0.081
0.6800	0.000826	0.000562	0.000	0.081
0.6894	0.000826	0.000570	0.000	0.081
0.6989	0.000826	0.000578	0.000	0.082
0.7083	0.000826	0.000585	0.067	0.082
0.7178	0.000826	0.000593	0.209	0.082
0.7272	0.000826	0.000601	0.397	0.083
0.7367	0.000826	0.000609	0.621	0.083
0.7461	0.000826	0.000617	0.876	0.083
0.7556	0.000826	0.000624	1.158	0.083
0.7650	0.000826	0.000632	1.466	0.084
0.7744	0.000826	0.000640	1.797	0.084
0.7839	0.000826	0.000648	2.149	0.084
0.7933	0.000826	0.000656	2.522	0.085
0.8028	0.000826	0.000663	2.914	0.085
0.8122	0.000826	0.000671	3.325	0.085
0.8217	0.000826	0.000679	3.753	0.086
0.8311	0.000826	0.000687	4.198	0.086
0.8406	0.000826	0.000695	4.660	0.086
0.8500	0.000826	0.000702	5.137	0.087

Name : 2 building rooves
Bypass: No

GroundWater: No

Pervious Land Use **acre**
Pervious Total **0**

<u>Impervious Land Use</u>	<u>acre</u>
ROOF TOPS FLAT	0.24
 Impervious Total	 0.24
 Basin Total	 0.24

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Name : Gravel Trench Bed 1
 Bottom Length: 80.00 ft.
 Bottom Width: 17.00 ft.
 Trench bottom slope 1: 3 To 1
 Trench Left side slope 0: 3 To 1
 Trench right side slope 2: 3 To 1
 Material thickness of first layer: 5
 Pour Space of material for first layer: 0.4
 Material thickness of second layer: 0
 Pour Space of material for second layer: 0
 Material thickness of third layer: 0
 Pour Space of material for third layer: 0
 Infiltration On
 Infiltration rate: 4
 Infiltration safety factor: 1
 Total Volume Infiltrated (ac-ft.): 183.249
 Total Volume Through Riser (ac-ft.): 0
 Total Volume Through Facility (ac-ft.): 183.249
 Percent Infiltrated: 100
 Total Precip Applied to Facility: 0
 Total Evap From Facility: 0
Discharge Structure
 Riser Height: 5 ft.
 Riser Diameter: 12 in.

Element Flows To:

Outlet 1	Outlet 2
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Gravel Trench Bed Hydraulic Table

<u>Stage(feet)</u>	<u>Area(ac.)</u>	<u>Volume(ac-ft.)</u>	<u>Discharge(cfs)</u>	<u>Infilt(cfs)</u>
0.0000	0.031	0.000	0.000	0.000
0.0667	0.032	0.000	0.000	0.125
0.1333	0.033	0.001	0.000	0.125
0.2000	0.033	0.002	0.000	0.125
0.2667	0.034	0.003	0.000	0.125
0.3333	0.035	0.004	0.000	0.125
0.4000	0.036	0.005	0.000	0.125
0.4667	0.037	0.006	0.000	0.125
0.5333	0.038	0.007	0.000	0.125
0.6000	0.039	0.008	0.000	0.125
0.6667	0.040	0.009	0.000	0.125
0.7333	0.041	0.010	0.000	0.125
0.8000	0.042	0.011	0.000	0.125
0.8667	0.043	0.012	0.000	0.125
0.9333	0.044	0.014	0.000	0.125

1.0000	0.045	0.015	0.000	0.125
1.0667	0.046	0.016	0.000	0.125
1.1333	0.047	0.017	0.000	0.125
1.2000	0.048	0.019	0.000	0.125
1.2667	0.049	0.020	0.000	0.125
1.3333	0.050	0.021	0.000	0.125
1.4000	0.051	0.023	0.000	0.125
1.4667	0.052	0.024	0.000	0.125
1.5333	0.053	0.025	0.000	0.125
1.6000	0.054	0.027	0.000	0.125
1.6667	0.055	0.028	0.000	0.125
1.7333	0.056	0.030	0.000	0.125
1.8000	0.057	0.031	0.000	0.125
1.8667	0.059	0.033	0.000	0.125
1.9333	0.060	0.034	0.000	0.125
2.0000	0.061	0.036	0.000	0.125
2.0667	0.062	0.038	0.000	0.125
2.1333	0.063	0.039	0.000	0.125
2.2000	0.064	0.041	0.000	0.125
2.2667	0.065	0.043	0.000	0.125
2.3333	0.066	0.045	0.000	0.125
2.4000	0.068	0.046	0.000	0.125
2.4667	0.069	0.048	0.000	0.125
2.5333	0.070	0.050	0.000	0.125
2.6000	0.071	0.052	0.000	0.125
2.6667	0.072	0.054	0.000	0.125
2.7333	0.073	0.056	0.000	0.125
2.8000	0.075	0.058	0.000	0.125
2.8667	0.076	0.060	0.000	0.125
2.9333	0.077	0.062	0.000	0.125
3.0000	0.078	0.064	0.000	0.125
3.0667	0.080	0.066	0.000	0.125
3.1333	0.081	0.068	0.000	0.125
3.2000	0.082	0.070	0.000	0.125
3.2667	0.083	0.073	0.000	0.125
3.3333	0.084	0.075	0.000	0.125
3.4000	0.086	0.077	0.000	0.125
3.4667	0.087	0.080	0.000	0.125
3.5333	0.088	0.082	0.000	0.125
3.6000	0.090	0.084	0.000	0.125
3.6667	0.091	0.087	0.000	0.125
3.7333	0.092	0.089	0.000	0.125
3.8000	0.093	0.092	0.000	0.125
3.8667	0.095	0.094	0.000	0.125
3.9333	0.096	0.097	0.000	0.125
4.0000	0.097	0.099	0.000	0.125
4.0667	0.099	0.102	0.000	0.125
4.1333	0.100	0.105	0.000	0.125
4.2000	0.101	0.107	0.000	0.125
4.2667	0.103	0.110	0.000	0.125
4.3333	0.104	0.113	0.000	0.125
4.4000	0.106	0.116	0.000	0.125
4.4667	0.107	0.118	0.000	0.125
4.5333	0.108	0.121	0.000	0.125
4.6000	0.110	0.124	0.000	0.125
4.6667	0.111	0.127	0.000	0.125
4.7333	0.113	0.130	0.000	0.125
4.8000	0.114	0.133	0.000	0.125
4.8667	0.115	0.136	0.000	0.125
4.9333	0.117	0.139	0.000	0.125
5.0000	0.118	0.147	0.000	0.125
5.0667	0.120	0.155	0.182	0.125
5.1333	0.121	0.163	0.509	0.125
5.2000	0.123	0.171	0.907	0.125
5.2667	0.124	0.180	1.318	0.125

5.3333	0.126	0.188	1.683	0.125
5.4000	0.127	0.197	1.960	0.125
5.4667	0.129	0.205	2.138	0.125
5.5333	0.130	0.214	2.300	0.125
5.6000	0.132	0.222	2.439	0.125
5.6667	0.133	0.231	2.571	0.125
5.7333	0.135	0.240	2.697	0.125
5.8000	0.136	0.249	2.817	0.125
5.8667	0.138	0.258	2.932	0.125
5.9333	0.139	0.268	3.042	0.125
6.0000	0.141	0.277	3.149	0.125

Name : 1 building roof

Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
Pervious Total	0
<u>Impervious Land Use</u>	<u>acre</u>
ROOF TOPS FLAT	0.12
Impervious Total	0.12
Basin Total	0.12

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 2	Gravel Trench Bed 2	

Name : Gravel Trench Bed 2

Bottom Length: 60.00 ft.

Bottom Width: 5.00 ft.

Trench bottom slope 1: 0 To 1

Trench Left side slope 0: 0 To 1

Trench right side slope 2: 0 To 1

Material thickness of first layer: 4

Pour Space of material for first layer: 0.4

Material thickness of second layer: 0

Pour Space of material for second layer: 0

Material thickness of third layer: 0

Pour Space of material for third layer: 0

Infiltration On

Infiltration rate: 4

Infiltration safety factor: 1

Total Volume Infiltrated (ac-ft.): 23.138

Total Volume Through Riser (ac-ft.): 0

Total Volume Through Facility (ac-ft.): 23.138

Percent Infiltrated: 100

Total Precip Applied to Facility: 0

Total Evap From Facility: 0

Discharge Structure

Riser Height: 4 ft.

Riser Diameter: 12 in.

Element Flows To:

Outlet 1	Outlet 2
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Gravel Trench Bed Hydraulic Table

<u>Stage(feet)</u>	<u>Area(ac.)</u>	<u>Volume(ac-ft.)</u>	<u>Discharge(cfs)</u>	<u>Infilt(cfs)</u>
0.0000	0.006	0.000	0.000	0.000
0.0556	0.006	0.000	0.000	0.027
0.1111	0.006	0.000	0.000	0.027
0.1667	0.006	0.000	0.000	0.027
0.2222	0.006	0.000	0.000	0.027
0.2778	0.006	0.000	0.000	0.027
0.3333	0.006	0.000	0.000	0.027
0.3889	0.006	0.001	0.000	0.027
0.4444	0.006	0.001	0.000	0.027
0.5000	0.006	0.001	0.000	0.027
0.5556	0.006	0.001	0.000	0.027
0.6111	0.006	0.001	0.000	0.027
0.6667	0.006	0.001	0.000	0.027
0.7222	0.006	0.002	0.000	0.027
0.7778	0.006	0.002	0.000	0.027
0.8333	0.006	0.002	0.000	0.027
0.8889	0.006	0.002	0.000	0.027
0.9444	0.006	0.002	0.000	0.027
1.0000	0.006	0.002	0.000	0.027
1.0556	0.006	0.002	0.000	0.027
1.1111	0.006	0.003	0.000	0.027
1.1667	0.006	0.003	0.000	0.027
1.2222	0.006	0.003	0.000	0.027
1.2778	0.006	0.003	0.000	0.027
1.3333	0.006	0.003	0.000	0.027
1.3889	0.006	0.003	0.000	0.027
1.4444	0.006	0.004	0.000	0.027
1.5000	0.006	0.004	0.000	0.027
1.5556	0.006	0.004	0.000	0.027
1.6111	0.006	0.004	0.000	0.027
1.6667	0.006	0.004	0.000	0.027
1.7222	0.006	0.004	0.000	0.027
1.7778	0.006	0.004	0.000	0.027
1.8333	0.006	0.005	0.000	0.027
1.8889	0.006	0.005	0.000	0.027
1.9444	0.006	0.005	0.000	0.027
2.0000	0.006	0.005	0.000	0.027
2.0556	0.006	0.005	0.000	0.027
2.1111	0.006	0.005	0.000	0.027
2.1667	0.006	0.006	0.000	0.027
2.2222	0.006	0.006	0.000	0.027
2.2778	0.006	0.006	0.000	0.027
2.3333	0.006	0.006	0.000	0.027
2.3889	0.006	0.006	0.000	0.027
2.4444	0.006	0.006	0.000	0.027
2.5000	0.006	0.006	0.000	0.027
2.5556	0.006	0.007	0.000	0.027
2.6111	0.006	0.007	0.000	0.027
2.6667	0.006	0.007	0.000	0.027
2.7222	0.006	0.007	0.000	0.027
2.7778	0.006	0.007	0.000	0.027
2.8333	0.006	0.007	0.000	0.027
2.8889	0.006	0.008	0.000	0.027
2.9444	0.006	0.008	0.000	0.027
3.0000	0.006	0.008	0.000	0.027
3.0556	0.006	0.008	0.000	0.027
3.1111	0.006	0.008	0.000	0.027
3.1667	0.006	0.008	0.000	0.027

3.2222	0.006	0.008	0.000	0.027
3.2778	0.006	0.009	0.000	0.027
3.3333	0.006	0.009	0.000	0.027
3.3889	0.006	0.009	0.000	0.027
3.4444	0.006	0.009	0.000	0.027
3.5000	0.006	0.009	0.000	0.027
3.5556	0.006	0.009	0.000	0.027
3.6111	0.006	0.009	0.000	0.027
3.6667	0.006	0.010	0.000	0.027
3.7222	0.006	0.010	0.000	0.027
3.7778	0.006	0.010	0.000	0.027
3.8333	0.006	0.010	0.000	0.027
3.8889	0.006	0.010	0.000	0.027
3.9444	0.006	0.010	0.000	0.027
4.0000	0.006	0.011	0.000	0.027
4.0556	0.006	0.011	0.138	0.027
4.1111	0.006	0.011	0.389	0.027
4.1667	0.006	0.012	0.703	0.027
4.2222	0.006	0.012	1.046	0.027
4.2778	0.006	0.012	1.383	0.027
4.3333	0.006	0.013	1.683	0.027
4.3889	0.006	0.013	1.921	0.027
4.4444	0.006	0.014	2.088	0.027
4.5000	0.006	0.014	2.203	0.027
4.5556	0.006	0.014	2.347	0.027
4.6111	0.006	0.015	2.462	0.027
4.6667	0.006	0.015	2.571	0.027
4.7222	0.006	0.016	2.676	0.027
4.7778	0.006	0.016	2.777	0.027
4.8333	0.006	0.016	2.875	0.027
4.8889	0.006	0.017	2.969	0.027
4.9444	0.006	0.017	3.060	0.027
5.0000	0.006	0.017	3.149	0.027

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1

Total Pervious Area:1.39

Total Impervious Area:0

Mitigated Landuse Totals for POC #1

Total Pervious Area:0.41

Total Impervious Area:0.87

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.051383
5 year	0.082169
10 year	0.106666
25 year	0.142585
50 year	0.173138
100 year	0.207108

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0

5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Stream Protection Duration

Annual Peaks for Predeveloped and Mitigated. POC #1

<u>Year</u>	<u>Predeveloped</u>	<u>Mitigated</u>
1949	0.057	0.000
1950	0.058	0.000
1951	0.049	0.000
1952	0.040	0.000
1953	0.032	0.000
1954	0.203	0.000
1955	0.062	0.000
1956	0.054	0.000
1957	0.075	0.000
1958	0.065	0.000
1959	0.051	0.000
1960	0.049	0.000
1961	0.102	0.000
1962	0.049	0.000
1963	0.083	0.000
1964	0.066	0.000
1965	0.041	0.000
1966	0.024	0.000
1967	0.048	0.000
1968	0.059	0.000
1969	0.190	0.000
1970	0.034	0.000
1971	0.063	0.000
1972	0.039	0.000
1973	0.038	0.000
1974	0.104	0.000
1975	0.040	0.000
1976	0.042	0.000
1977	0.030	0.000
1978	0.035	0.000
1979	0.116	0.000
1980	0.055	0.000
1981	0.034	0.000
1982	0.044	0.000
1983	0.094	0.000
1984	0.046	0.000
1985	0.061	0.000
1986	0.137	0.000
1987	0.062	0.000
1988	0.032	0.000
1989	0.041	0.000
1990	0.044	0.000
1991	0.045	0.000
1992	0.034	0.000
1993	0.033	0.000
1994	0.031	0.000
1995	0.046	0.000
1996	0.086	0.000
1997	0.170	0.000
1998	0.028	0.000
1999	0.037	0.000
2000	0.032	0.000
2001	0.011	0.000
2002	0.042	0.000
2003	0.033	0.000

2004	0.056	0.000
2005	0.039	0.000
2006	0.134	0.000
2007	0.099	0.000
2008	0.115	0.000
2009	0.035	0.000

Stream Protection Duration

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.2033	0.0000
2	0.1902	0.0000
3	0.1705	0.0000
4	0.1375	0.0000
5	0.1341	0.0000
6	0.1164	0.0000
7	0.1150	0.0000
8	0.1040	0.0000
9	0.1019	0.0000
10	0.0991	0.0000
11	0.0944	0.0000
12	0.0859	0.0000
13	0.0832	0.0000
14	0.0746	0.0000
15	0.0656	0.0000
16	0.0649	0.0000
17	0.0633	0.0000
18	0.0622	0.0000
19	0.0616	0.0000
20	0.0612	0.0000
21	0.0588	0.0000
22	0.0581	0.0000
23	0.0572	0.0000
24	0.0558	0.0000
25	0.0545	0.0000
26	0.0538	0.0000
27	0.0507	0.0000
28	0.0493	0.0000
29	0.0491	0.0000
30	0.0491	0.0000
31	0.0482	0.0000
32	0.0459	0.0000
33	0.0456	0.0000
34	0.0448	0.0000
35	0.0445	0.0000
36	0.0435	0.0000
37	0.0424	0.0000
38	0.0418	0.0000
39	0.0414	0.0000
40	0.0405	0.0000
41	0.0400	0.0000
42	0.0397	0.0000
43	0.0390	0.0000
44	0.0389	0.0000
45	0.0385	0.0000
46	0.0372	0.0000
47	0.0351	0.0000
48	0.0350	0.0000
49	0.0343	0.0000
50	0.0342	0.0000
51	0.0336	0.0000
52	0.0332	0.0000
53	0.0327	0.0000
54	0.0324	0.0000

55	0.0323	0.0000
56	0.0322	0.0000
57	0.0311	0.0000
58	0.0301	0.0000
59	0.0285	0.0000
60	0.0238	0.0000
61	0.0112	0.0000

Stream Protection Duration

POC #1

The Facility PASSED

The Facility PASSED.

Flow(cfs) Predev Mit Percentage Pass/Fail

0.0257	14765	0	0	Pass
0.0272	12350	0	0	Pass
0.0287	10217	0	0	Pass
0.0302	8560	0	0	Pass
0.0316	7135	0	0	Pass
0.0331	5961	0	0	Pass
0.0346	5011	0	0	Pass
0.0361	4261	0	0	Pass
0.0376	3593	0	0	Pass
0.0391	3074	0	0	Pass
0.0406	2633	0	0	Pass
0.0421	2257	0	0	Pass
0.0436	1917	0	0	Pass
0.0451	1644	0	0	Pass
0.0465	1467	0	0	Pass
0.0480	1304	0	0	Pass
0.0495	1178	0	0	Pass
0.0510	1077	0	0	Pass
0.0525	1001	0	0	Pass
0.0540	921	0	0	Pass
0.0555	837	0	0	Pass
0.0570	782	0	0	Pass
0.0585	718	0	0	Pass
0.0599	672	0	0	Pass
0.0614	635	0	0	Pass
0.0629	610	0	0	Pass
0.0644	582	0	0	Pass
0.0659	551	0	0	Pass
0.0674	518	0	0	Pass
0.0689	498	0	0	Pass
0.0704	480	0	0	Pass
0.0719	455	0	0	Pass
0.0734	436	0	0	Pass
0.0748	416	0	0	Pass
0.0763	396	0	0	Pass
0.0778	382	0	0	Pass
0.0793	363	0	0	Pass
0.0808	348	0	0	Pass
0.0823	336	0	0	Pass
0.0838	323	0	0	Pass
0.0853	312	0	0	Pass
0.0868	299	0	0	Pass
0.0882	288	0	0	Pass
0.0897	276	0	0	Pass
0.0912	265	0	0	Pass
0.0927	245	0	0	Pass
0.0942	235	0	0	Pass
0.0957	221	0	0	Pass
0.0972	207	0	0	Pass

0.0987	197	0	0	Pass
0.1002	187	0	0	Pass
0.1016	174	0	0	Pass
0.1031	164	0	0	Pass
0.1046	153	0	0	Pass
0.1061	146	0	0	Pass
0.1076	135	0	0	Pass
0.1091	126	0	0	Pass
0.1106	112	0	0	Pass
0.1121	95	0	0	Pass
0.1136	80	0	0	Pass
0.1151	68	0	0	Pass
0.1165	61	0	0	Pass
0.1180	55	0	0	Pass
0.1195	46	0	0	Pass
0.1210	41	0	0	Pass
0.1225	39	0	0	Pass
0.1240	37	0	0	Pass
0.1255	32	0	0	Pass
0.1270	30	0	0	Pass
0.1285	20	0	0	Pass
0.1299	18	0	0	Pass
0.1314	14	0	0	Pass
0.1329	8	0	0	Pass
0.1344	7	0	0	Pass
0.1359	5	0	0	Pass
0.1374	5	0	0	Pass
0.1389	4	0	0	Pass
0.1404	4	0	0	Pass
0.1419	4	0	0	Pass
0.1434	4	0	0	Pass
0.1448	4	0	0	Pass
0.1463	4	0	0	Pass
0.1478	4	0	0	Pass
0.1493	3	0	0	Pass
0.1508	3	0	0	Pass
0.1523	3	0	0	Pass
0.1538	3	0	0	Pass
0.1553	3	0	0	Pass
0.1568	3	0	0	Pass
0.1582	3	0	0	Pass
0.1597	3	0	0	Pass
0.1612	3	0	0	Pass
0.1627	3	0	0	Pass
0.1642	3	0	0	Pass
0.1657	3	0	0	Pass
0.1672	3	0	0	Pass
0.1687	3	0	0	Pass
0.1702	3	0	0	Pass
0.1716	2	0	0	Pass
0.1731	2	0	0	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 acre-feet
On-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.
Off-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.

LID Report

LID Technique	Used for	Total Volume	Volume	Infiltration	Cumulative
---------------	----------	--------------	--------	--------------	------------

Percent Volume Infiltrated	Water Quality	Percent Treatment? Water Quality Treated	Comment Needs Treatment (ac-ft)	Through Facility (ac-ft)	Volume (ac-ft.)	Volume Infiltration Credit
Gravel Trench Bed 1 POC 100.00		N	166.76			N
Sand Filter 1 0.00		N	124.51			N
Gravel Trench Bed 2 POC 100.00		N	21.06			N
Total Volume Infiltrated 60.13	0.00	0%	312.33	0.00	0.00	No Treat. Credit
Compliance with LID Standard 8 Duration Analysis Result = Passed						

PerlnD and Implnd Changes

No changes have been made.

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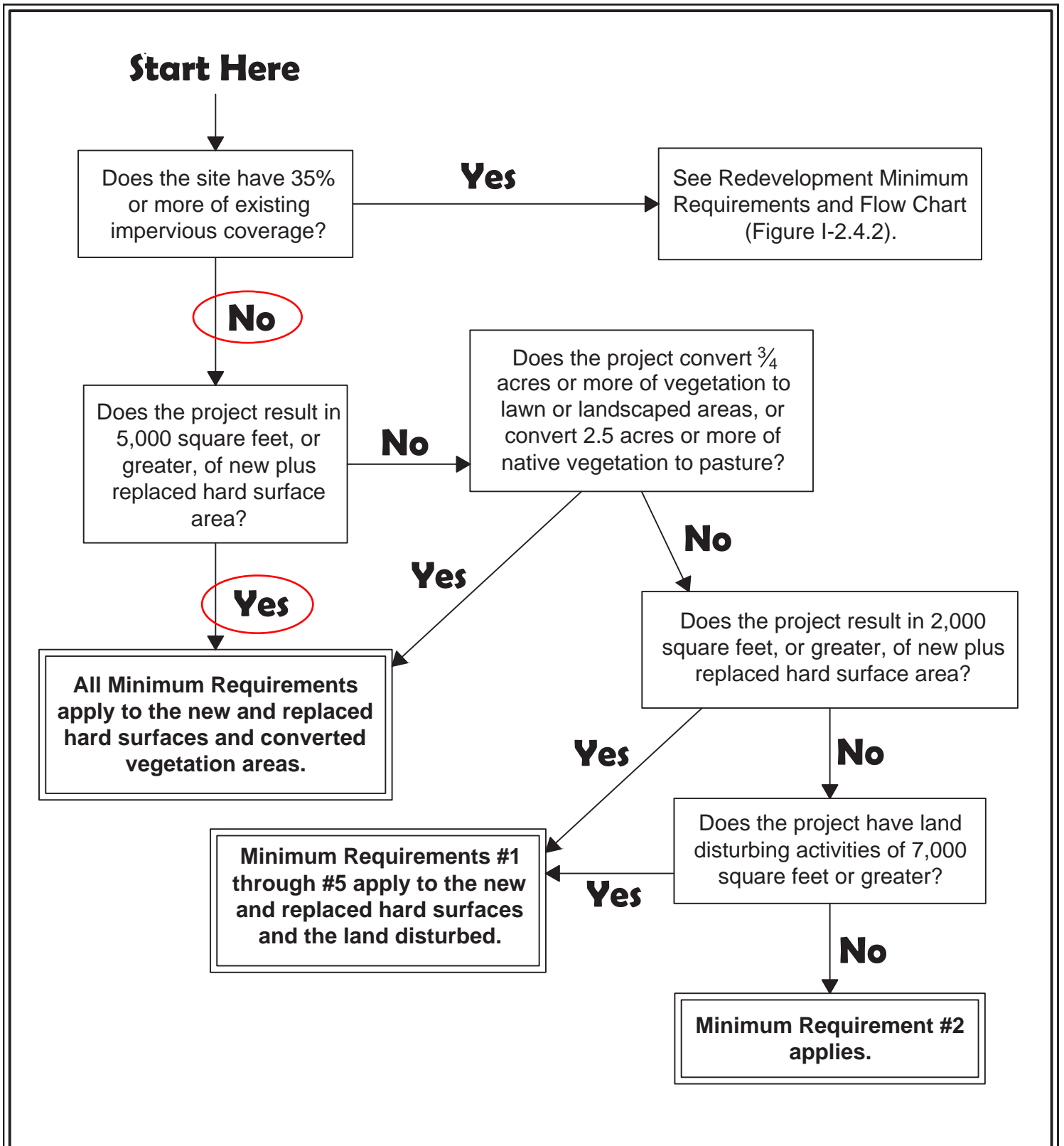


Figure I-2.4.1
Flow Chart for Determining Requirements for New Development

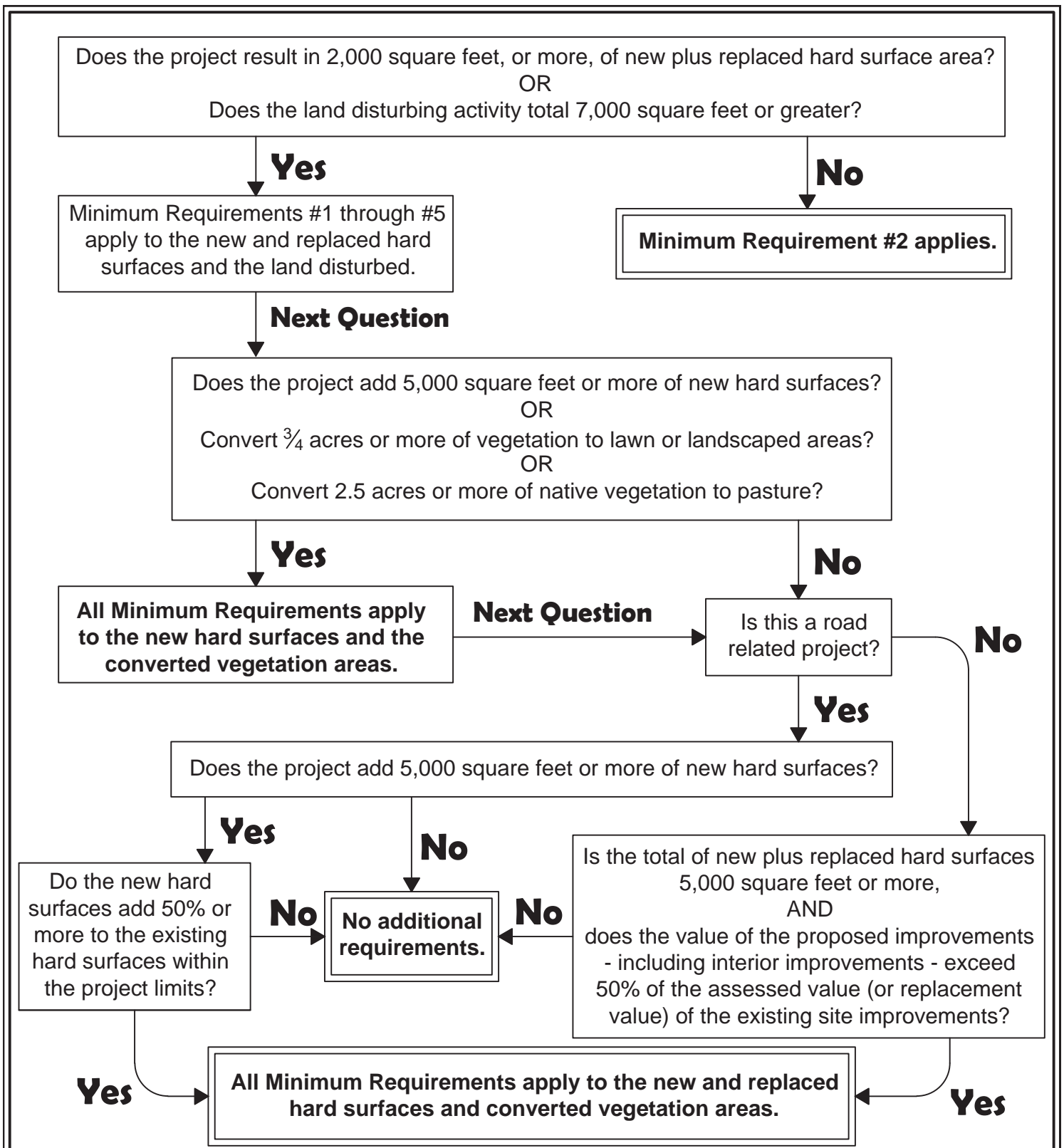


Figure I-2.4.2
Flow Chart for Determining Requirements for
Redevelopment

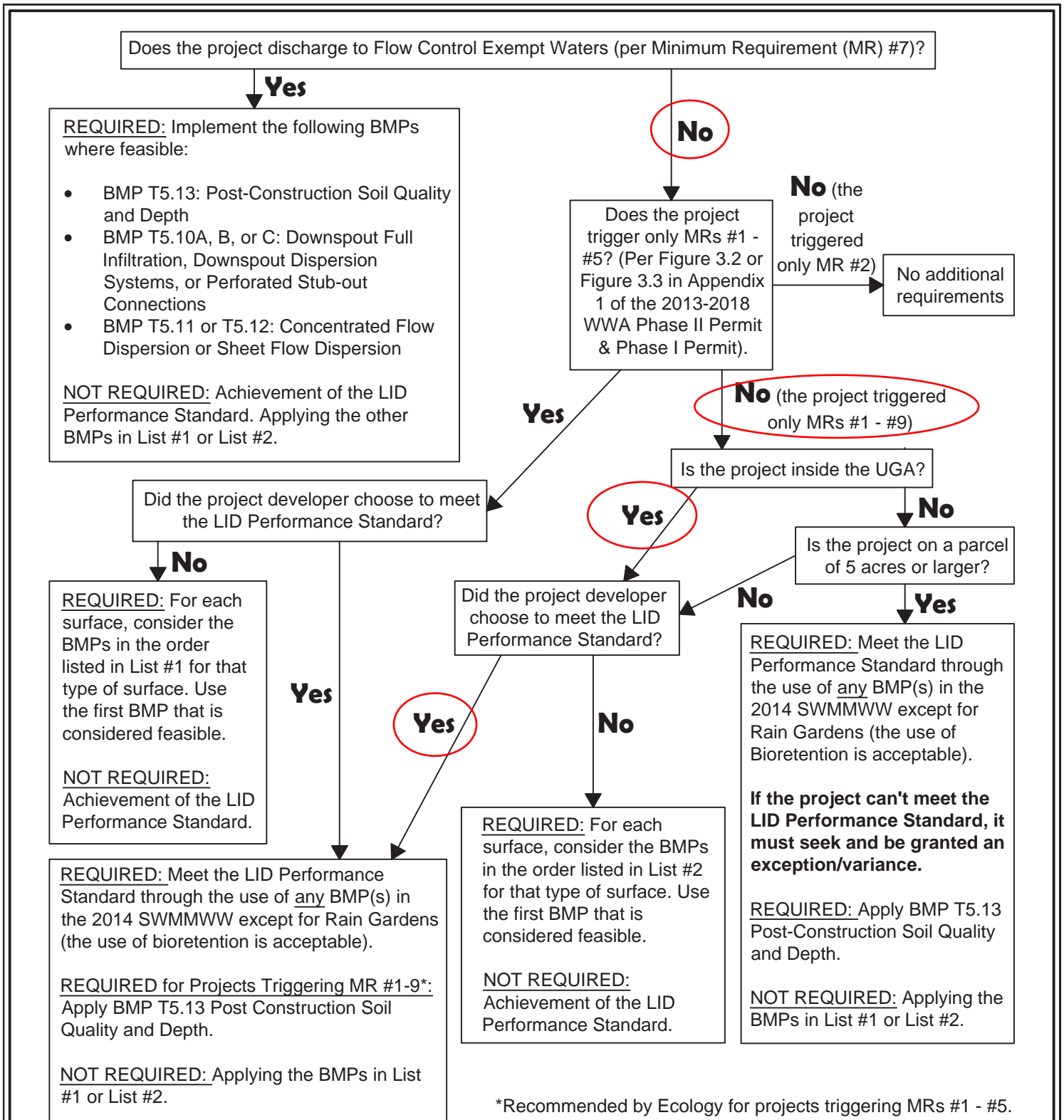
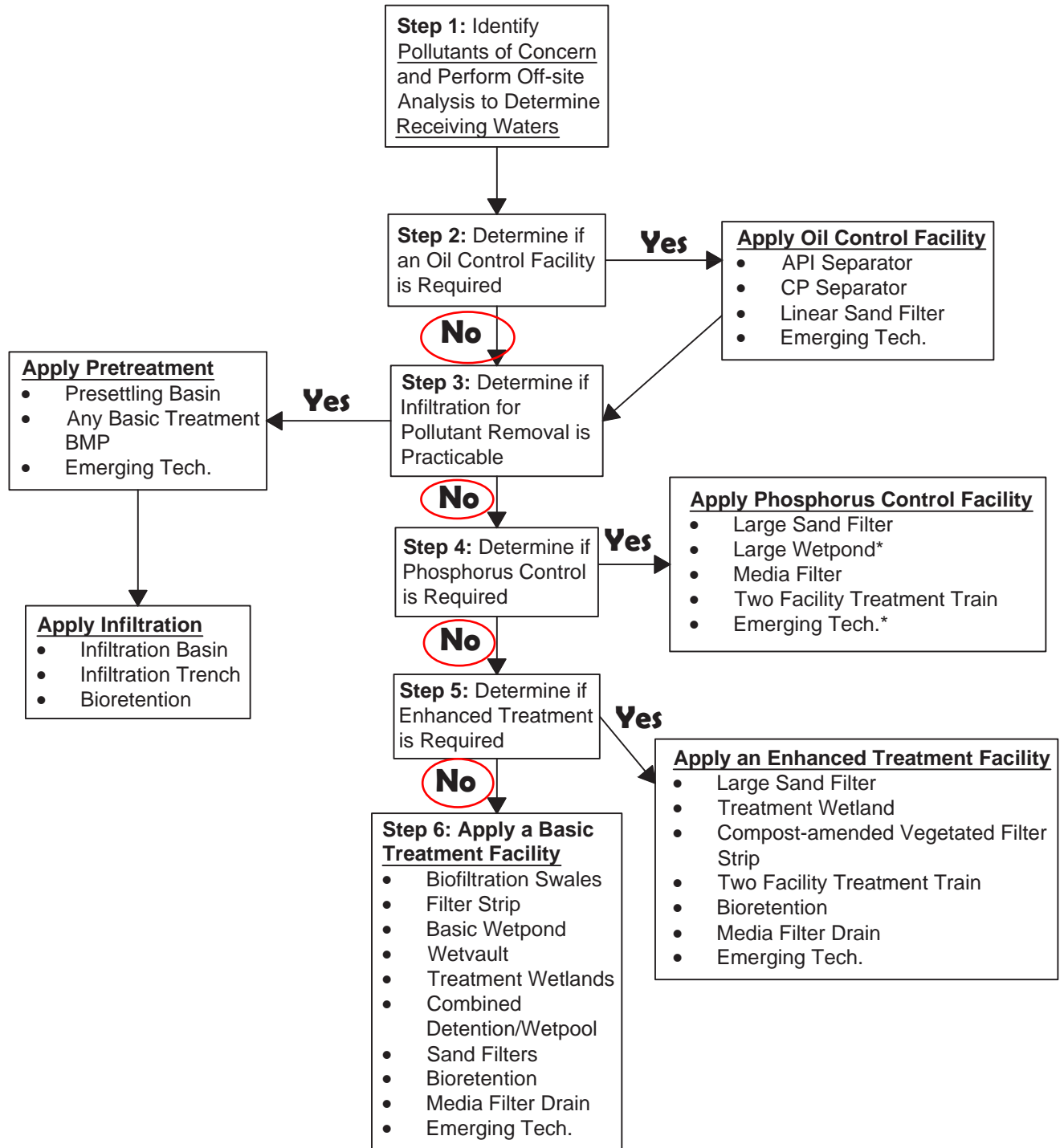


Figure I-2.5.1 Flow Chart for Determining LID MR #5 Requirements

Revised June 2015

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*When **Phosphorus Control and Enhanced** treatment are required, the Large Wetpond and certain types of emerging technologies will not meet both types of treatment requirements. A different or an additional treatment facility will be required to meet Enhanced treatment.



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State of Washington

Figure V-2.1.1 Treatment Facility Selection Flow Chart

Revised December 2015

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